Paparella IV: Section 1: Plastic and Reconstructive Surgery

Chapter 3: Local Flaps

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Surgical excision is one of the mainstays of treatment for both benign and malignant cutaneous lesions of the head and neck. Local flaps provide the basis of reconstruction for most of these defects. The good soft tissue coverage provided, combined with an excellent color match, makes them popular with most surgeons. Inherent in the use of these flaps is knowledge of good tissue handling. The surgeon must be patient, meticulous, and equipped with functioning, nontraumatic instruments.

Although the diagnosis of cutaneous lesions is often evident clinically, definitive histologic diagnosis should be obtained before major surgical resections are undertaken. For small lesions an excisional biopsy is adequate; larger lesions may require a punch biopsy or an incisional biopsy that includes normal skin. There is controversy over the closure of defects following excision of malignant lesions. It is argued that using a flap to cover such defects will mask recurrence. In addition, the flaps can make repeat excision of positive margins less accurate, if this is necessary on the basis of the final pathology report. Most skin lesions can be accurately removed using frozen section control and thus be reconstructed primarily. Caution should be exercised in dealing with basal cell carcinomas of the morphea type, malignant melanoma, and any recurrent tumors. If any of these lesions are aggressive, one should give serious consideration to skin grafting to allow observation of the resected bed.

The Mohs technique of excision is extremely reliable, and when it is used primary reconstruction can be undertaken. This technique is indicated for recurrent tumors, morphea-type basal cell carcinomas, and lesions of the eyelids, canthus, nasal ala, and ear.

In the presence of malignant lesions, care must be taken to make a full assessment of the head and neck and in particular an accurate assessment of cervical lymphatics. Despite the potential deformities of surgical excision, removal of the malignancy is the first and foremost priority and reconstruction comes second. The possibility of difficult reconstruction should not be allowed to compromise proper oncologic technique.

Anatomy

Knowledge of the relaxed skin tension lines of the face are essential to the proper planning of local flaps. Skin incisions should be placed in these lines for maximal cosmetic effect. One should also avoid designing flaps that cause unnecessary pull in important areas. Downward pull of the lower lid can lead to ectropion, and pull at the oral commissure can lead to noticeable asymmetry.

Blood supply to the face is derived from the facial and superficial temporal branches of the external carotid and the supraorbital, supratrochlear, zygomaticofacial, and zygomaticotemporal branches of the internal carotid. The location of these vessels and any history of previous damage should be considered when planning flaps. The blood supply to most local flaps is random pattern (see Chap. 4), with flaps based on the supraorbital and supratrochlear vessels being axial pattern. In a random pattern flap with no major vessels entering the base, the surviving length is proportional to the width of the base. When known vessels are entering the base of a random pattern flap, however, the surviving length can be extended (eg, in a nasolabial flap).

In some locations the facial nerve lies very superficially and becomes prone to injury. These positions include the temporal branch at a point halfway between the lateral canthus and the external auditory canal as it passes over the zygoma, and the mandibular branch of the nerve extending from the angle of the mandible to the region of the mental foramen. The parotid duct also lies superficially throughout its course. Its position can be identified by drawing an imaginary line from the level of the tragus to the oral commissure.

Classification

The most common classification of local flaps relates to the movement of the flap into the defect. Under this system the following types are identified:

1. *Advancement.* These flaps are moved directly into the defect in a direction perpendicular with the base of the flap.
2. *Rotation.* These are generally semicircular and are rotated into the defect about an arc.
3. *Transposition.* These are elevated and rotated into a defect by passing them over an incomplete bridge of skin.
4. *Interpolation.* These are elevated and rotated into a defect by passing them over or under a complete bridge of skin between the donor site and the defect. If the flap is passed *under* the bridge of skin, the portion of the flap that is buried is deepithelialized.

Design

Advancement Flaps

Direct advancement of a rectangular flap of skin into a defect or advancement of the edges of a fusiform excision are the two varieties of this type of flap.

A fusiform excision is placed in the direction of the relaxed skin tension lines and designed so that the apices of the excision measure 30 degrees. This allows closure without puckering of the edges. After excision the skin edges are undermined for an approximate distance of 2 cm on each side and then advanced into the defect.

The rectangular flap is designed by extending two parallel incisions away from the edge of the defect, usually in the relaxed skin tension lines, and then elevating and advancing the flap into the defect. It is often necessary to excise Burow's triangles from the nonmobilized skin at the base of the flap. These flaps are often used on the forehead, cheek, or lip.

Rotation Flaps

Rotation flaps are very commonly used and come in three basic varieties.

Simple Rotation. These flaps are designed to fill a triangular defect so that the ratio of the size of the flap to the defect is 4:1. This ratio is not essential, however, and is often exceeded, especially in the design of cheek flaps. The flap is generally designed in the shape of a semicircle and rotated into position. It is often necessary to excise a Burow's triangle from the nonmobilized skin at the base of the flap. These flaps are ideal for medial canthal and cheek defects.

V-Y Rotation. These flaps are designed in a similar fashion but often with less of an arc. The pivot point of the flap is designed in the shape of a V and closed in the shape of a Y to allow tension-free rotation of the flap into the defect. This variation may also exist as an advancement flap (eg, in lengthening the base of the columella). The V-Y rotation flap is very useful in the nasal region.

O-Z Rotation. This variation involves the use of two opposing, inverted, semicircular rotation flaps to close a circular defect. The final closure is in the shape of a Z. These flaps should be designed so that each one extends from the midpoint of the defect. It is quite useful for lateral forehead defects.

All these flaps are minor variations on the same theme - rotation of skin about an arc into a defect. The design must ensure that the base is not too narrow in order not to compromise blood supply. This is particularly true with the V-Y flap.

Transposition Flaps

Transposition flaps are more complicated in design but are also more versatile in their use. The common varieties of this flap are described below.

Simple Transposition. This flap is outlined adjacent to the defect, elevated, and then transposed into position over an intervening bridge of skin. It can also be interpolated into the defect. The nasolabial and glabellar transposition flaps are excellent examples; their design is simple and the donor site can invariably be closed primarily. When the flap is interpolated a second stage is necessary, 3 to 4 weeks after the initial stage, to take down the bridging skin.

Bilobed. This consists of two transposition flaps that are outlined adjacent to the defect. Classically they are designed at 90 degrees to the defect and to each other, but this is not essential and they may be designed at angles less than 90 degrees. The first lobe is designed to be approximately the size of the defect; the second to be approximately one-half as wide and three-fourths as long. Both lobes are then transposed and the secondary donor site is closed primarily.

Rhombic. This flap is classically designed to fill a rhombic defect with apical angles of 60 degrees and side angles of 120 degrees. A flap equal to the size of the defect is then constructed parallel to one side of the defect so that the base of the flap is at one of the 60-degree apices. The flap is then transposed into position and the donor site closed. This classic rhombic flap creates a donor site equal to the size of the defect and thus often results in a difficult primary closure of the donor site. It does function, however, to transfer the line of pull of a closure. The point of closure of the donor site is the area under most tension and should ideally be placed in the relaxed skin tension lines. However, this may not be possible because it may create an incorrect direction of pull.

A modification of this flap involves using 30-degree angles at one apex by means of an M-plasty and creating a donor flap that is smaller than the defect. This allows easier closure of the donor site.

Z-plasty. Although this flap is commonly used in scar revisions, it can also be employed for small tumor excisions. When a Z-plasty is utilized for scar revision, the scar is taken as the central member of the Z. The relaxed skin tension lines are identified and the scar chosen as the direction that the central member will fall in after transposition. A line is then drawn through the midpoint of the central member in the direction of the relaxed skin tension lines. Lateral members of the same length as the central member are now extended from each pole of the central member so as to intersect with the relaxed skin tension lines (RSTL). The flaps are then transposed into position.

This procedure not only changes the direction of a scar, but also lengthens the scar area and creates a more acceptable broken line closure. The classic flap is 60 degrees at the apex, although this is not necessary and the angle can be smaller. When using smaller angles, however, one must be aware of the possibility of tip necrosis; if necessary multiple Z-plasties should be used in order to decrease the size of each flap.

Application

The choice of flap depends heavily on the region affected. Each area has its own distinct features that make some flaps acceptable and others totally inadequate. One must not only search for a way of obtaining local tissue, but obtain tissue in a way that does not distort the local aesthetic appearance or compromise function. In some areas, eg, the superficial nasal dorsum and tip lesions, a full-thickness skin graft is simple and more acceptable.

For purposes of discussion the face can be divided into regions: central forehead, temporal, medial canthus and cheek, lateral cheek, and nose.

Central Forehead

Anatomically the structures of concern in the designing of flaps for this region are the hairline and the eyebrows. Flaps should be designed to avoid pull on these areas. The skin of the forehead is also different in that it is quite thick and skin grafts tend to be unacceptable.

A very popular flap in this region that avoids any vertical pulls is the rectangular advancement flap. It can be designed in the relaxed skin tension lines and provides very acceptable results. For moderate-sized defects the rotation flaps can be useful, in particular the O-Z flap. Large defects often require multiple serial advancement flaps, and tissue expansion may be useful.

Temporal

The major concern in this region is pull on the lateral canthus or hairline. Care must also be taken to avoid injury to the temporal branch of the facial nerve. The rhombic flap is quite useful here. Ideally it should be constructed so that the donor limb is in a skin tension line, but direction of pull should be of prime concern. For small defects the O-Z flap is again useful.

Medial Canthus and Cheek

This is a common area needing repair because of the occurrence of basal cell carcinomas. A combination of glabellar and cheek flaps repairs most defects. For small lesions near the canthus and on the lateral surface of the nose, either a simple glabellar transposition flap or a V-Y rotation flap close most defects. For large defects a large cheek rotation flap, combined with a glabellar or midline forehead flap, suffices. The cheek skin is more acceptable because it more closely resembles lower lid and canthal skin. If the cheek advancement must fill a large area, it can be bilobed by placing an accessory lobe in the postauricular area. This is often necessary to avoid excess tension at the closure site.

Lateral Cheek

This area is a rich source of loose skin. It is essential to avoid injury to the parotid duct and branches of the facial nerve. Almost any rotation or transposition flap can be used for small to moderate-sized defects. The rhombic and bilobed flaps are popular here. For large defects, cervicofacial rotation or bilobed flaps can be used. Direction of pull is less of a concern, allowing the surgeon to take time to design the most cosmetically acceptable flap.

Nose

Flaps for nasal repair may be divided into those for the upper half and those for the lower half. The skin of the upper portion is thin and more mobile. Flaps that are easily used here include the simple transposition, bilobed transposition, or rhombic flaps.

The lower half (the nasal tip) requires much more thought, since minor pulls on the tip or alae produce cosmetic and functional alterations. Lesions at the tip can be repaired using either a midline forehead, a V-Y rotation, or a rectangular advancement flap. The rotation and advancement flaps provide more acceptable skin but cause more pull on the tip. The V-Y rotation flap decreases the pull somewhat by decreasing tension at the donor site. One other option is to interpolate a nasolabial flap.

For more lateral nasal tip defects the midline forehead flap is still an excellent choice. When the nasolabial angle becomes involved, a combination of nasolabial or cheek advancement flaps can be utilized. If inner and outer lining is necessary, the edges of these flaps can be turned on themselves, and if support is needed, cartilage can be sandwiched between the turned edges.

Most local flaps are simple in their design and execution. One must remember to place oncologic principles first and avoid using flaps that compromise function. For novice it is useful to separate the face into regions and have at least one flap that can be relied on for each region. Design should be kept as simple as possible. Experience alone can guide the selection for each area.